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EDITORIAL

The Diploma in Anæsthetics.

THE time is now up within which application might be made to receive the D.A. without examination. The original period had been slightly extended, chiefly in order to put the facility within the power of a number of overseas anæsthetists. It is unfortunate, but unavoidable, that a strict time limitation of this sort, determined as it is by the period for which the candidate has occupied his qualifying office, must always create a certain number of hard cases. There will always be men who just fail by a few months, even perhaps by a few weeks, to have achieved the necessary length of service before the limit is reached. Everything was done, we feel certain, by the Colleges to keep the "hard cases" to the lowest possible number.

Other "hard cases" arise where the candidate whose competency and experience may be beyond question has yet not occupied the post of anæsthetist to a hospital which comes within the class of those which alone are recognized by the authorities as fulfilling the necessary requirements. These are the hardest cases, because for those in the position indicated the examination is not open either, unless they set to and produce the required evidence of the necessary number of recorded cases of administrations for major and other surgery.

We believe that there have been one or two other "hard cases" arising from the fact that the applicant, although a British subject, for the D.A. is rightly limited to British subjects, was practising as an anæsthetist and achieved his qualification for the diploma in a non-British locality. We sympathize with all those who may regard themselves as "hard cases", but we are convinced that everything possible has been done to keep the standard set for the diploma, while at the same time inflicting the minimum of what might appear to be injustice.

The institution of a Diploma in Anæsthetics has been such a notable success that one wonders whether perhaps some other body may not imitate the example set by the Royal Colleges. So long as the body were one of sufficient authority and the tests it set were of no lower standard than those devised by the Colleges, we can see no harm in the production of such an additional diploma. What, however, we would most like to see would be some means of facilitating the candidature of our overseas colleagues. It can easily be imagined that many an anæsthetist in Canada, for example, but still more in the more distant Australia and New Zealand, is prevented from sitting for the examination because of the distance he must traverse to meet it and the loss of time and the expense involved. We hope to see the day when it may be possible for those men to receive visiting examiners from England just as now happens with regard to some of the examinations of the Royal College of Surgeons.

BLOOD SUPPLY CHANGES DURING CYCLOPROPANE ANÆSTHESIA

BY

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EXCESSIVE bleeding during surgical operations can be caused by many factors other than the anæsthetic agent. The question first to be answered in an investigation into the reason why more than usual haemorrhage appears to accompany any one type of anæsthesia could be stated as follows: "Is bleeding increased only when the agent in question is being used?"

Cyclopropane, whose anæsthetic properties have more recently been discovered, is rapidly replacing its hydrocarbon predecessor, ethylene, as the agent most often accused of being responsible for increased bleeding during surgical procedures. The opinion that haemorrhage is excessive during operations under cyclopropane anæsthesia has been independently expressed by a number of surgeons and some anæsthetists situated in widely separated localities. It has been our experience that where the anæsthetic agent was unknown to the surgeon its identification merely by clinical estimation of the degree of bleeding during operation was usually not possible. While some observers simply state they witness more bleeding during cyclopropane anæsthesia,

others, including Griffith of Montreal, further qualify their criticism to include only capillary oozing. There appears to be general agreement that bleeding from the uterus in operative obstetrics, especially during Caesarean section, seems less than when other more commonly employed anæsthetics are used.

Suggested Methods of Study.

Observations have already been made[1] regarding the bleeding and clotting time of the blood before, during, and following cyclo-propane anæsthesia, and no definite change was noted. It is, therefore, necessary that other experimental procedures be considered. An estimation of the total blood-loss during operation by complete recovery from sponges, packs, towels, instruments, etc., would afford a direct method. However, the difficulties and objections are numerous and because of individual differences in vascularity, an exceedingly large number of determinations would be necessary to arrive at any definite conclusion. We have on this account used more indirect methods of investigation, including a comparison of splanchnic and peripheral blood-pressure in dogs and a study of peripheral blood-supply changes in both animals and humans.

Present Study.

Although we have been concerned mainly with blood-supply changes during cyclopropane anæsthesia, for purposes of comparison, some observations have been made during the various depths of ether narcosis.

The method devised by Hanzlik, De Eds, and Terada[2] to determine changes in the blood-flow in the ear of the rabbit by measuring changes in opacity with the aid of the photo-electric cell was so modified to make it suitable for studies on humans. The apparatus (Fig. 1) consists of (1) A source of light, namely a 10-watt lamp, the intensity of which is regulated by a non-flickering carbon rheostat. (2) A Weston photronic cell. (3) A Weston D.C. microammeter model 622.

The ear or some other translucent vascular area is interposed between the source of light and the photo-electric cell. An increase in the blood-supply of the area renders it more

opaque to the passage of light and thus reduces the current output of the photo-electric cell. Likewise a decrease in the amount of blood in the ear renders it more translucent, allowing more light to pass through, and results in an increase in current output of the cell. The terminals of the cell are connected to the galvanometer or microammeter which has a maximum needle deflection of 5 microamperes with 100 scale divisions, hence each scale division represents 0.05 microamperes.

The casing for the photo-electric cell is made of light sheet-metal and supports an adjustable hollow tube upright 2 centimetres in diameter and 10 centimetres high into the top of which is placed the lamp. The ear or other translucent skin area is inserted between the upper and lower segments of the tube. Light from a foreign source is prevented from entering by sponge rubber cushions which are attached to both the proximal and distal segments of the tube. These cushions, while they exclude light, are so adjusted that they will not constrict the blood-vessels. The possible error due to the heating of the light bulb was greatly reduced by making a series of observations instead of one continuous record. At the present time an attempt is being made to improve the apparatus by the addition of a suitable heat filter in order that a reliable continuous record might be obtained.

In humans, we have tried to correlate changes in depth of anæsthesia and fluctuations in blood-pressure with peripheral blood-supply changes as determined by differences in the current output of the photo-electric cell.

In dogs an oncometer was placed on the kidney to measure changes in its volume, a canula was inserted into the carotid artery for blood-pressure and the photo-electric cell was attached to the ear or the loose vascular flank of the female, which afforded a more satisfactory location if the ear was deeply pigmented.

Technique of Administration of Cyclopropane.

All the clinical cases were premedicated with a morphine-scopolamine combination or morphine and a barbiturate. The animals were all unpremedicated, and following induction of anæsthesia were rapidly intubated to insure against

changes due to respiratory obstruction. The carbon dioxide absorption technique with the "to and fro" canister of soda lime was employed from the time of induction of anæsthesia and continued throughout in both humans and animals. Some of the patients were intubated and in others respiratory obstruction was guarded against by pharyngeal airways.

Studies Without Anæsthesia.

We used the apparatus, described above, on ourselves to see if any change in current output of the photo-electric cell took place due to the heating effect of the lamp at the time the microammeter readings were made. No change was noted after 20 minutes when readings were taken at 2- and 5-minute intervals. An increase in the room temperature was noted to influence the peripheral blood-supply, causing a decrease in the cell current output before any feeling of increased warmth could be detected subjectively.

Moderate carbon dioxide excess (Fig. 2), such as occurs when oxygen is rebreathed for a short time, alters markedly the blood-supply to the ear. The blood-supply is increased as indicated by a diminished cell-current output, but sometimes this increase is preceded by a transient decrease in blood-supply and a consequent increase in the output of the photo-electric cell. The increased blood-supply resulting from an increase in tension of the inspired carbon dioxide is progressive in character and continues for some minutes after the mask is removed. Rebreathing was continued to the point of discomfort from carbon dioxide accumulation, but no additional carbon dioxide from a cylinder was used in any of the experiments. Following the diminished current output produced by carbon dioxide excess it was noted that the sudden application of cold to an extremity, such as was obtained by splashing ether suddenly on the forearm, quickly increased the current output of the cell. As a rule the changes in blood-supply were paralleled by changes in both the systolic and diastolic blood-pressure. During the recovery phase, however, the peripheral blood-supply changes lagged behind the return of the blood-pressure to its pre-experimental level.

As a result of the aforementioned findings it was con-

sidered imperative to guard against any possible carbon dioxide accumulation or depletion during any stage of anæsthesia, cyclopropane and ether, each of which is capable of producing any depth of anæsthesia in the presence of an abundance of oxygen, were selected for comparison.

Normal Reaction of the Photo-electric Cell to Changes in Cyclopropane Anæsthesia.

During anæsthesia for extra-abdominal surgery, where the operative procedure is not attended with shock, the changes in the current output of the cell appear to bear a definite relationship to the depth of anæsthesia. In a typical case (Fig. 3) immediately anæsthesia is induced there occurs an increased cell output signifying an initial decrease in blood-supply. Simultaneously there usually occurs a slight rise in blood-pressure of say 10 mm. Hg. and there may be a further increase in blood-pressure, but nevertheless a reduction in cell current output. From this point on peripheral blood-supply changes bear more of a relationship to the depth of anæsthesia than to the change in blood-pressure. When anæsthesia is deepened there is a decrease in current output and an increase when it is lightened, indicative of an increase and decrease respectively in the blood-supply to the ear. The sensitiveness of the apparatus is remarkable and such slight differences in depth of anæsthesia as between the upper and lower borders of a single plane will cause variations in the current output of the cell independent of any change in blood-pressure.

Impending Surgical Shock.

In the presence of a constant plane of anæsthesia, we noted that an increased current output (Fig 4) preceded any change of blood-pressure, pulse-rate, or colour in a patient who five minutes later showed the characteristic progressive decline in blood-pressure and increase in pulse-rate which, if untreated, invariably leads to shock. After treatment was instituted the current output began to diminish. There was very little bleeding during the course of the operation.

Hæmorrhage.

The behaviour of the cell during operations, complicated

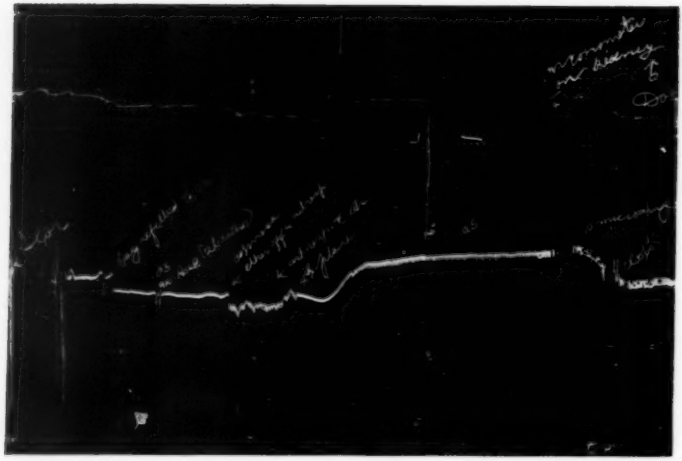

FIG. 7

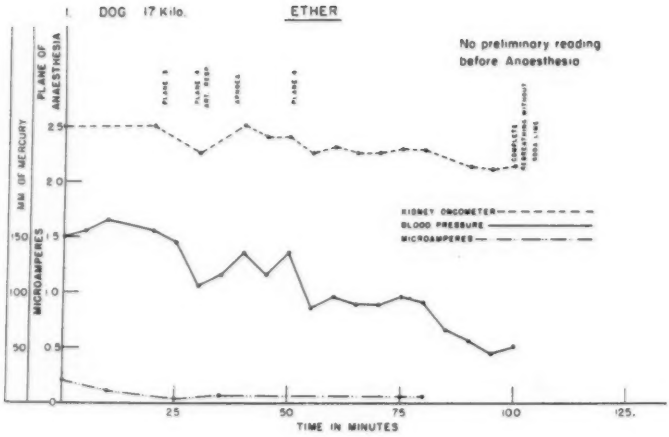
1. DOG 17 Kilo.
ETHER
No preliminary reading before Anaesthesia
PLANE OF ANAESTHESIA
MM OF MERCURY
MICROAMPERES
KIDNEY ONCOMETER
BLOOD PRESSURE
MICROAMPERES
TIME IN MINUTES
25
50
75
100
125.

FIG. 8

These data would lead us to believe that there is a difference in the distribution of the blood during anæsthesia with cyclopropane and with ether. During cyclopropane anæsthesia the peripheral blood-supply appears to be influenced most and the splanchnic, insofar as can be ascertained by changes in kidney-volume, the least. In the course of ether anæsthesia the peripheral blood-supply changes are less remarkable while the splanchnic variations are quite distinctive.

Discussion.

Returning now to the question asked in the opening paragraph, "Is bleeding increased during cyclopropane anæsthesia?" it appears we do not have the answer by reason of this study alone. On the other hand, our findings might afford a reasonable explanation of why bleeding may appear to be greater during cyclopropane anæsthesia than during ether anæsthesia of comparable depth. The changes in peripheral blood-supply which occur within the upper and the lower limits of a single plane of cyclopropane anæsthesia suggests the retention of tonicity of the peripheral arterioles and capillaries. During ether anæsthesia there appears to be vasodilatation which changes very little with light or profound narcosis.

Conclusions.

1. The photo-electric cell affords an excellent qualitative method of studying blood-supply changes in humans as well as in animals.

2. Definite changes in blood-supply occur during ether and cyclopropane anæsthesia which are peculiar to each of the two agents.

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THE ASSOCIATION OF ATROPINE WITH ETHER CONVULSIONS

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TWO instances of ether convulsions successfully treated by evipan have recently been reported by S. Taylor and V. Goldman. A considerable number of such cases has now been recorded, so that probably the majority of anæsthetists would regard an intravenous injection of evipan as the routine treatment for this puzzling condition. The immediate interest in the first case lies in the admittedly excessive dose of evipan given, which almost proved fatal, and should provide a timely warning to the over-bold anæsthetist.

During 17 years of anæsthetic work I neither experienced nor saw ether convulsions. I then had three cases in two months, and a fourth less than four months later. Possibly no one as yet has had, nor desires to have, such a concentrated experience. The first of these has been fully reported elsewhere. Two were small children suffering from acute mastoiditis; in two, a different pair, there was respiratory obstruction; two, again a different pair, were successfully treated with evipan: all recovered. It might be thought that this sequence was just another example of what has been so frequently observed in the practice of medicine, the occurrence of two or more instances of a rarity in close proximity: actually there is a feature which may be regarded as significant, as I shall presently show. My third case is worthy of consideration in some detail.

On July 26th, 1937, B.S., a female aged 3 years and 3 months, had her tonsils enucleated by guillotine and adenoids

curetted under vinesthene and oxygen, being discharged from hospital on the following day.

On the evening of July 30th she was readmitted to the Llannelly Hospital for right-sided acute mastoiditis, which was said to have developed since the tonsillectomy.

Atropine gr. 1/100 was given half an hour before operation, which commenced at 6.45 p.m. Induction was by ethyl chloride and ether on an Ogston's mask. When the head was turned to the side the lower half of the top of the mask was occluded by a piece of gamgee clipped into position and a small stream of oxygen was directed through a rubber tube to the upper half. This method, besides being very economical as regards ether consumption, has the advantage that it permits a considerable degree of rebreathing, and conserves the patient's CO_2. No artificial airway was employed on account of the condition of the pharynx. Respiration was not very satisfactory, being intermittent, gasping, and obstructed.

At 7.30 p.m., towards the end of the operation, the right forearm was seen to be alternately flexing and extending at the elbow. Nothing else was noticed, for nothing else was visible on account of the arrangement of the towelling. The surgeon suggested that the patient was "light", but there was no other evidence to support this. When the towels were removed from the head, definite convulsive spasms were evident. These became very severe, leaving off for the space of two or three respirations, and recurring, the condition resembling a status epilepticus, and cyanosis was marked.

Elevation of the head and the administration of oxygen and CO_2 had no effect on the convulsions. Evipan, 1.5 c.c., was injected into a vein at the elbow, and the convulsions ceased. The temperature in the axilla was 105.9°F. Coramine 0.7 c.c. was given.

At 8.15 p.m., after return to the ward, the convulsions recommenced, but were tonic, with the fingers held in the position of tetany. Calcium sandoz 5 c.c. was injected into the buttock as a vein could not be entered. Later, as no improvement was evident, a 2-gr. suppository of nembutal was given. The temperature had fallen to 101.4.

At 12.30 a.m. on the 31st, she was reported as having

had five fits of short duration in an hour. A vein at the elbow was exposed by dissection and about 3 c.c. of evipan given very slowly during a quarter of an hour. During the night she had no further convulsions, but was reported as having "twitched" twice. In the morning she replied when spoken to, took water without vomiting, and passed urine: she had a lateral nystagmus. She was given 0.5 c.c. of coramine at 10 a.m., and was kept on water, milk of magnesia and Secway.

The child became restless towards evening of the 31st and was given 2½ grains of bromide, to be repeated p.r.n. She was quiet next morning. No further convulsions occurred. She was put on sodium bicarbonate, glucose, and saline rectally.

On the 2nd August the urine contained a trace of sugar, acetone and diacetic acid were present.

The subsequent course of healing was normal, though rather slow, but she was discharged from hospital on September 10th. At this time her behaviour was suggestive of mental deficiency, but the mother when questioned noticed nothing abnormal.

I have just seen this child again: she has recently started to attend school. She appears bright and intelligent and has a good memory; in short, she seems none the worse for her ordeal. The parents, by the way, are convinced that any trouble the doctors had was due to her being thoroughly exhausted, having had no proper sleep between the first operation and the second.

The paper referred to above includes an attempt to group the known aetiological factors in a diagram in the form of a genealogical tree. The upper part, the root ancestors so to speak, is excellent; the association of sepsis, over-atropinization, and high environmental temperature, to which might be added the pernicious habit of covering the body in mackintoshes, leading to hyperthermia, is generally agreed. I regard the condition essentially as a form of heat-stroke. Unfortunately the lower steps in the tree descend into the realms of romance. On reading accounts of reported cases, which have already developed into a formidable literature, there is no general suggestion of hyperpnoea; there was not the

slightest evidence of this in any of my own four cases.

Starting from this false premise, the next step not unnaturally falls. There is no general loss of CO_2 (indeed some writers have even suggested that the cause is excess of CO_2), and therefore no unusual degree of alkalæmia. The hypothesis that the state of the blood calcium had something to do with the onset of ether convulsions was most unfortunate. It arose from the fancied analogy to tetany, and it was expected that the blood in these cases would show a deficiency in calcium. It did not require the lapse of many months to demonstrate that the blood calcium remained within normal limits. The next step was the propounding of the theory that while the serum calcium remained normal, it was the ionized and physiologically active fraction which was at fault. I am afraid that this is simply begging the question, for it can neither be proved nor disproved.

Professor E. C. Dodds, of the Courtauld Institute of Biochemistry, very kindly examined a specimen of blood taken from my first case, which I sent him with this object in view. The serum calcium was within normal limits, 9.8 mgs. per 100 c.c., and in a covering letter he regrets his feeling that the question of ionised calcium is a very complicated one to attack, as it requires a collection of blood under the most careful conditions with regard to retaining the carbon dioxide. I fear this is impracticable in an operating theatre during a serious emergency. One patient who developed ether convulsions (Daly) had been having intravenous injections of calcium twice daily for several weeks. Several anæsthetists (Shackleton, Human, Cartwright) have reported the cessation of convulsions either immediately or soon after the injection of calcium: it has also failed to take effect (Hudson). The fact that ether convulsions have ceased after the intravenous injection of a dose of calcium is no proof at all of any calcium deficiency.

Any search for the cause of ether convulsions must take into account the history of anæsthesia. The consensus of opinion amongst most writers on this subject is to the effect that the first cases occurred during the years 1926–27, and that from that date to the present time they have been cropping up with considerable frequency and regularity. This is

not strictly accurate. Sykes refers to five cases met with by one observer, Kirkby Thomas, between 1913 and 1925, and to another (details not given) in 1922. However, for 70 or 80 years chloroform, ether, ethyl chloride, and nitrous oxide had been administered to innumerable patients suffering from all manner of complaints under all sorts of conditions, many of these quite unfavourable, without any record of convulsions. Either they did not occur at all or they were so uncommon that they may have been ascribed to epileptic or uræmic fits, and were disregarded. It is inconceivable that they could have happened with the frequency which has been experienced during the last ten years and have passed unnoticed.

The various causes which have been suggested simply will not fit into the picture. The presence of anoxæmia, excess or deficiency of CO_2, deep and prolonged anæsthesia, septic conditions, streptococci in the nasal mucosa, high theatre temperature, increase or diminution of calcium in the blood, over-oxygenation, aldehyde and peroxide as impurities in the ether, and the like have all been present severally or in combination in countless thousands of administrations, and although one or more of these may, and doubtless does, provide a predisposing condition, none of them can be regarded as the exciting cause, unless it can be demonstrated that under modern conditions it arises in a concentration previously unknown. Cartwright refers to the suggestion that an impurity may be present in ether which has not been suspected and so not considered in the analysis, that there is, in fact, a new impurity arising from the modern mass production of the drug. This is not very convincing, but it is at least a reasonable proposition.

I incline to the belief that the offending agent, the last straw as it were, is atropine. There is a certain vagueness about the origin of atropine in pre-medication. It is stated that it began to be used during the first decade of the present century. It was certainly not in use in my medical school when I received my first introduction to anæsthetics as a student in, I think, 1911. From my own experience in military and other hospitals I know it was not universally employed at least one or two years after the termination of the war.

There must now be very many anæsthetists who have had no experience of the era before pre-medication was the rule. A mask of Schimmelbusch or Bellamy-Gardner type covered by layers of lint or gauze rested upon a strip of gauze coiled about the patient's nose and mouth. The head was turned towards one side, and ether deluged upon the mask. It drenched the layers of gauze, including the quite inadequate face protection, it dripped from its edges on to the face and neck, and formed a pool on the pillow. Dense fumes of ether flowed over the edge of the table floorwards. Alternatively large areas of the gauze froze, forming a thick layer of ice through which the patient was unable to respire. As often as not the patient was blue, very blue. The conjunctivae were swollen and the vessels injected; a gag was permanently inserted between the teeth on the patient's upper side; a tongue forceps of Guy's pattern was indenting the tongue. Periodically the mask, with its saturated trimmings, was removed, the mouth forced open, and a collection of mucus baled out from the mouth and pharynx. Occasionally a Clover's apparatus was used for a change. The results were, if possible, even worse. The whole picture resembled rather a war-time casualty from phosgene gas-poisoning than an anæsthetic administration.

At first sight it must appear surprising that pre-medication with atropine, which wrought such a revolutionary change, took so many years before it came to be universally adopted. The fact is, however, that atropine was not introduced with the object of checking the flow of mucus at all. It was given partly with a view to minimizing post-anæsthetic vomiting, and to combat surgical shock by preventing excessive perspiration, but chiefly as a corrective to the undesirable effects of morphine, namely depression of the respiration and circulation, and above all as a protection against vagal inhibition by chloroform.

Anæsthesia was generally induced by pure chloroform, followed by open ether. Some anæsthetists used morphine with or without scopolamine, prior to operation, and it was these who found the need for atropine. Moreover the dose of atropine employed was much smaller than that to which we are accustomed to-day. Further the methods for the

separation and purification of the alkaloids have improved, and looking back on my earlier experience with hypodermic tablets, I have a shrewd suspicion that they often contained a smaller proportion of the active principle than that optimistically stated on the wrapper.

In 1909 Buxton gives a careful and detailed account of practical anæsthesia, including the previous preparation of the patient, for house surgeons and others. He makes no mention of atropine, but he deals with the flow of mucus and saliva during ether administration, and advocates full doses of tincture of belladonna for the subsequent bronchial complications.

In 1911 the writer (Silk) of the chapter on anæsthetics in Rose and Carless refers to the preliminary administration of scopolamine gr. 1/64 and morphine gr. $\frac{1}{6}$ as being "recommended by some authorities as a means of inducing ordinary sleep. There is a good deal of difference of opinion as to the value of the procedure . . . further experience is required." He does not mention atropine.

In the same year Probyn-Williams, in an account of ether given by the 'open' method states: "During light anæsthesia the patient can easily be maintained in a good condition without any cyanosis, and often without much secretion of mucus and saliva. The administration is often preceded by a hypodermic injection of morphine gr. $\frac{1}{6}$ with atropine gr. 1/120."

In 1914 Caird writes: "The preliminary injection of morphine with or without scopolamine is of great value from the psychological point of view." He uses the term 'mixed anæsthesia' to indicate the employment of certain drugs as adjuvants, the objects in view being to allay anxiety, to soothe pain and ensure sleep after the operation, to diminish excitement, and, in the case of atropine, to protect the heart against reflex inhibition, whilst also restraining oral and bronchial mucous secretion, which is especially liable to occur when ether is used. There is also advice on how to deal with the saliva, preventing its accumulation in the mouth, which sounds strangely in our ears to-day.

Blomfield, in 1919, gives ten rules for the choice of anæsthetics: "For abdominal operations when the patient is par-

ticularly muscular or much accustomed to alcohol or tobacco, and the operation requires very complete relaxation, give ¼ gr. morphine half an hour before operation, in combination with atropine 1/120 gr." This is the only group for which atropine is specifically advised, but later, describing ether by the open method, he refers to the saturation of the mask, and to the air of the operating-room becoming considerably laden with the vapour, and says, "to be certain of success with 'open ether' the administration should be preceded by morphine gr. ¼, atropine gr. 1/120."

It is not until 1920 that Buxton is able to write: "Atropine salts for adults is now practically always employed before ether." The dose recommended has increased; it is given as gr. 1/150 to gr. 1/100. Even so Buxton was writing of up-to-date practice in London. I very much doubt whether 'practically always' would be a correct description to supply to the country as a whole at that time. In the same year Shipway laments the practice of giving the same dose of morphia, viz ⅙ gr., as a routine to all patients irrespective of individual requirements. Atropine he entirely ignores.

Subsequently the dose of atropine was further increased. Pinson, in his paper based on 15 cases of ether convulsions in 1925 and 1926, says of the eleventh in this series: 'One-sixtieth grain of atropine was given shortly before operation (which all the previous cases, too, had in doses suitable to their ages)." Wilson, in 1927 or previously, was giving 1/60 gr. atropine as a routine to adults: in the same year he reviews nine cases at the Manchester Royal Infirmary, and attributes the phenomena to impurities, acetaldehyde and peroxide, found in samples of ether.

In my own practice up to the middle of 1936 the maximum dose of atropine which I was in the habit of ordering, with a very few special exceptions, was 1/100 grain. Since that date I have increased my dose, apart from small babies my minimum dose is now gr. 1/100, and the great majority of adults are receiving gr. 1/75 or gr. 1/60. This is the factor to which I made reference at the beginning of this paper: all my cases of ether convulsions occurred last year.

There is one other point to which I would draw attention. Mr. Goldman's first case had to undergo the ordeal of a

second operation two days later. He very wisely gave paraldehyde beforehand; a much better way out of the difficulty than his alternative proposal, cyclopropane, for this class of case. I do feel that we anæsthetists are not making sufficient use of the basal narcotics. The reasons are, of course, that we have not the time to superintend large numbers in addition to our anæsthetic duties; that a responsible substitute to ourselves is not always available for a process which calls for prolonged attention, and we dare not entrust the matter to an unreliable agent; and the difficulty of working to a precise time-table, an essential to obtaining the best results.

Should this country ever secure a really efficient hospital service, a prospect which seems to grow more remote, surely a much larger proportion of our patients would receive the benefits of this boon. Much of the interest attached to our work lies in the scope for individuality which anæsthesia provides, but in the long run the experience of any one of us probably does not diverge vastly from the general average. On looking over my first consecutive 1,000 administrations for the current year, from which 172 spinal analegsias, with or without a general anæsthetic superadded, may be deducted, it is with something akin to self-reproach that I have to confess that only 48 had paraldehyde or avertin.

Summary.

1. It is suggested that the casual agent which is actively responsible for the onset of ether convulsions, at any rate in the very great majority of intances, is atropine.

2. The incidence of ether convulsions corresponds with the adoption of atropine as a pre-medicant, and particularly with the employment of increased dosage.

3. The more extended use of basal narcotics is advised as a preventive measure.

4. The routine treatment should include an early intravenous injection of evipan sodium, or other suitable barbiturate.

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DEATHS UNDER ANÆSTHESIA FROM 1921 TO THE PRESENT DATE

By RONALD JARMAN, D.S.C., D.A.

(Abstracted from a paper read before the Section of Anæsthetics, Royal Society of Medicine.)

WHEN I first thought of writing this paper I had a vision that it would not be difficult to compile a reasonable statistical review of deaths under or associated with anæsthesia. I believed that it was merely a matter of collecting the details of anæsthetic deaths from as many hospitals as could be written to, and consequently the leading medical centres of the English-speaking countries were approached. As a result of these inquiries I received careful and detailed letters from the secretaries and registrars of various hopitals, and I would like to thank them most sincerely for the immense amount of work that they must have gone to in order to provide me with the analysis of the two million figures that have been prepared. So far, all efforts to bring the data into line have proved a failure, and it is practically impossible to draw any reasonable statistical conclusion from the mass of material that has been sent to me.

There is hardly an anæsthetist who has not in the forefront of his mind the possibility that a death may occur during the administration of an anæsthetic. Yet one finds that up to the present moment there is not an anæsthetic body that has ever attempted to record anæsthetic deaths in such a way that the causes may be discovered and consequently classified. The persons involved are concerned primarily in finding some condition arising in the patient in order to exculpate all concerned from blame, instead of conducting an impartial, and if necessary, private inquiry into the circumstances. This became so necessary in South Africa

that a special investigation was demanded into the deaths following the administration of the various types of anæsthetics that are used to-day. The results of this inquiry and of the papers read at the Centenary Celebrations in Australia will be referred to towards the end of this paper, when the conclusions that have been obtained will be enunciated.

The hospitals that have assisted me in this research and that have been keeping records as well as holding inquiries into deaths on the operating table, number among them such famous names as Guy's, University College Hospital, Newcastle Royal Victoria Infirmary, etc. It may be of interest to know that I have received from hospitals in this country alone 25 reports, in addition to the conclusive ones from Australia, South Africa and America.

Let us now turn to the Registrar-General's statistical review. In his commentary he states that the anæsthetic agents recorded on the death certificates have altered considerably in recent years, and that there has been a definite increase in the deaths associated with ethyl chloride and ether. "It need scarcely be pointed out that these fatalities depend upon the extent to which the various agents are used as well as upon the risk attaching to them. But unfortunately the deaths associated with each type of anæsthetic cannot be collated with the number of its administrations. It is not even possible to say whether, or to what extent, the rapid increase in the number of these deaths implies increased mortality under anæsthetics. The number of administrations is known to be increasing, but cannot be estimated. The deaths tabulated, moreover, can only be those under, not those caused by, anæsthesia. It is impossible from certification to distinguish between deaths from operation under anæsthesia and deaths due to the anæsthetic itself."

There has been a decrease in the deaths where the barbituric acids have been employed. Where there were 36 in 1935 there are only 17 in 1936, which is the latest report obtainable. One cannot help being impressed by the fact that since 1921 there has been a steady increase in the number of deaths under or associated with the administration of anæsthetics. The number of deaths has doubled itself in the last ten years alone. The reason or reasons are numerous:

it may be that the surgeon has become bolder in the operations he attempts, and treats on an ever-increasing scale patients who were previously considered inoperable.

It was of interest at this point to draw a graph showing the effect on the different sexes, and it is quite clear that the majority of women die across the child-bearing period and that men die across the prostatic period.

In view of the regular rise in the number of deaths it hardly seems to be possible that any changes in the anæsthetic drugs themselves can have added materially to the increase, either for the better or the worse.

Because of its higher mortality rate, chloroform had to be abandoned in favour of ether. At the present moment it does not seem possible to find any definite statistical evidence that this is so. Goodman Levy, in his book on *Chloroform Anæsthesia*, published in 1922, compiled a table to show that a large proportion of deaths under anæsthesia were those in which chloroform was used. In another table he compares pure chloroform with chloroform and ether mixtures, and it is to be noted that while there is a decline of chloroform deaths from 95 to 88, there is an increase in the chloroform and ether deaths from 5 to 56, a total increase of 44. It is of interest at this point to glance at a graph of the decline in the use of chloroform and ether mixtures at one of the leading teaching hospitals in London. Over this period of nine years the number of administrations have dropped from 4,000 to 750, and there were some 12 deaths during that time. The only two deaths which occurred in 6,900 anæsthetics of all types during 1938 happened under chloroform and ether administrations.

The controversial question of spinal anæsthesia is also of interest. The only figures that are available are those that are reported by Myra E. Babcock, M.D., of Detroit, U.S.A. From these figures it would appear that the deaths occurring under spinal anæsthesia compare reasonably with those under forms of anæsthesia when the anæsthetist has had a very considerable amount of experience.

The inaccuracy of figures is well borne out in an unusual paper which was read at the Royal Society of Medicine in 1913 by Dr. Flemming of Bristol, who collected 700 cases

out of the lay Press. These are shown and contrasted with the figures as issued by the Registrar-General for the same years. There is rather a glaring discrepancy.

What are the causes of these deaths? Are we as anæsthetists to hold ourselves responsible? On going through the list of nearly 1,300 deaths—cases with full details that have been sent to us—the anæsthetist who has been in charge of the case has been the House Officer. Statistics collected by Bortone of New Jersey U.S.A., prove conclusively that it is the newly qualified interne or house officer who is responsible for the majority of deaths on the table. It would be extremely unkind to criticize the house officer, for surely it is obvious that the responsibility placed on him is far too great. One willingly admits that we have all got to learn, but according to the inquiry made into various reports, the fact is that the majority of these deaths occur at the changing over of newly qualified men.

Once more, what are the causes of these deaths? Is it the anæsthetist, is it the method, or is it the anæsthetic and equipment? Let us take the anæsthetist first.

There are three groups of anæsthetists to-day—the full-time anæsthetist who specialises in anæsthetics, the doctor who gives anæsthetics more or less regularly in general practice, and the newly qualified house officer who has only recently joined the staff of a hospital. I am purposely omitting the resident anæsthetist. It is the last group that seems to take the blame in this series of cases, and it is found that very nearly 80 per cent of the cases died with the house officer in charge, 12 per cent with the general practitioner, and 8 per cent with the full-time anæsthetist.

With regard to the house officer, the embarrassing increase of deaths on the table in acute cases happens after the appointment of new men, and they can be obviated altogether if the full-time or honorary anæsthetist were personally to supervise the anæsthetics through this period, until he is satisfied in his own mind that the house officer is able to cope with any situation that might arise.

With regard to anæsthetic and equipment, one might mention that every operating theatre should contain suction pumps, the right types of apparatus for giving gases under

pressure if needs be, and the necessary emergency apparatus for giving saline and glucose so as to cut down the risk of the operation and to assist the anæsthetist in ensuring that everything possible has been done in cases of acute emergency.

It might be an advantage to see a comparison of the types of anæsthetics used at three hospitals for the year 1938. There were two deaths at the teaching hospital. Both occurred under chloroform and ether continued with ether, and one patient died of concealed intra-uterine hæmorrhage and the other during an operation for a cerebral abscess. There were four deaths at the General Hospital. One was a man of 50 with a perforated carcinoma of the colon. He had gas and oxygen anæsthesia and died ten minutes after the operation. The second case was a woman of 30 who died under a spinal while being operated on for ectopic gestation. The third case was a woman of 64 undergoing a cholecystectomy, and the anæsthetic sequence was pentothal, percain, gas and oxygen. The last case was a woman of 58, who was given pentothal, gas, oxygen and ether for an ovarian cystectomy. Of the 326 pentothal inductions at this hospital, 107 were followed by a spinal. At the provincial hospital there were two deaths: both were brain operations. One patient had avertin, gas, oxygen and minimal ether continued with endotracheal ether, and the other was premedicated with omnopon and scopolamine, followed by gas, oxygen and ether, continued with ethyl chloride and oxygen.

Out of the series of 1,300 detailed cases, the following classifications have been made: Deaths under ether alone, 130; spinals, 81; gas oxygen and ether, 50; chloroform alone, 29; intravenous, 21; acute abdomens, 121; brain operations, 70; appendicectomies, 65; gynæcological operations, 61; thyroids, 43; labour cases, 43; non-acute abdomens, 35. The remainder of the deaths consisted of tonsil cases, mastoids, chests, orthopædics, etc. As there are quite a number of anæsthetists interested in dental anæsthetics, it is gratifying to know that out of over 400,000 gas administrations in the chair, consisting of gas and air, gas and oxygen, ethyl chloride and vinyl ether, there has not been a single death. There were, however, 14 cases of death in the

theatre, but no comparison can be drawn for these figures as it is not known how many other dental operations have been performed in the theatre without any fatality.

Intravenous anæsthesis is very much in our minds at the present moment, and according to the latest reports received, administrations are now in the region of 8,000,000 and about 264 deaths have been reported associated with this type of anæsthesia.

Generally speaking all that can be determined at the moment is that evidently there are more deaths under anæsthesia in the North and Midlands than there are in the London Hospitals. This is just one set of figures, and it can be assured that, comparing it with the figures obtained from the Registrar-General for the last 15 years, it has varied very little except that the totals grow larger every year.

In concluding this paper I would like to quote the remarks made by Professor Waters, of America, with regard to the deaths under anæsthesia. He states that he would not attempt to say whether anæsthesia was or was not the whole factor in any death. A few of these deaths on the table could probably be laid down directly to anæsthesia, and nothing else in that they occurred before the surgeons' efforts had progressed sufficiently to be damaging. Even here, however, the condition of the patient was a contributory factor.

The whole subject is summed up extremely well by Dr. Paul M. Wood, of New York City, who expressed the opinion that seldom is the agent any more at fault than the method and skill of the anæsthetiser: "given a properly trained and qualified anæsthetist morbidity and mortality fall, regardless of the agent, technique or patient condition."

My own conclusions are these: It is hoped that in future all hospitals will produce a complete registrar's report which can be referred to by those people who are following on in anæsthesia so that they may learn and form conclusions;

That all students taking up anæsthesia either as a profession or as a means to an end, should be encouraged to do more anæsthetics while in training and that more post-graduate classes should be run so as to assist the general practitioners who are responsible for anæsthesia in their cities and that they should take full advantage of these facilities;

That it should become a law to assist the house officer in his first few weeks of office in the administration of all kinds of anæsthetics, especially in acute cases;

That the expert anæsthetist should be responsible for all new drugs placed on the market, and even he should be asked as far as possible to make sure that these drugs are only used on suitable cases while still in the experimental stage, as valuable drugs may go into disrepute owing to the inexperience of the administrator.

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THE MEDICAL PRESS AND CIRCULAR CENTENARY

ALTHOUGH the *Medical Press and Circular* celebrated its centenary in January, this is our first opportunity of commenting on the event and of congratulating its present editor and proprietors on the splendid health of their progeny after a hundred years of existence. Looking back, we doubt if the journal has ever before quite reached that standard which it has now attained, taking into account not only the matter presented on its pages but the manner of its presentation and the illustrations which accompany it. Many of our readers will have seen the centenary number of Wednesday, January 25th. To those who have not done so we recommend an early perusal, for they will find a record of the achievements of the last hundred years in the various branches of medical science told with terseness, accuracy, and attraction.

They will find also a most entertaining account of a number of great figures of Victorian medicine accompanying the exquisite caricatures provided for *Vanity Fair* by "Ape" and by "Spy" (Pellegrim, 1839–1889, and Sir Leslie Ward 1857–1922). This article is from the pen of Sir Allan Thornton, who was able to write with personal knowledge of the majority of those depicted. His first subject is Sir William Jenner, who died in 1898, and his last, Sir Francis Barlow, who is happily still with us.

The cartoons are beautifully reproduced. Sir Ernest Graham-Little supplies an account of the history of medical education in the last hundred years, and the number is completed by a chronological list of the medical societies and journals in the British Isles. Altogether the centenary number of the *Medical Press and Circular* is one which we cordially recommend to the readers as worthy not only of perusal but of preservation.

Besides the issue of a centenary number the proprietors celebrated the occasion by giving a banquet at Claridge's to a large number of medical men, including two editors of some twenty-four medical journals. Speeches were made by Lord Horder, Sir Humphry Rolleston, Mr. Cecil Wakeley, Mr. Eric Pearce Gould, and one of the proprietors of the journal, Mr. R. F. West. The lucky diners were all presented with copies of *The Medical Press and Circular*, 1839-1939, a history of the journal fully told by Professor R. J. Rowlette, and beautifully printed, illustrated and bound.

THE DIPLOMA IN ANÆSTHESIA

The following have been granted the diploma without examination:

Joseph Adams, M.B., B.Ch., B.A.O. (Queen's University, Belfast).
Hazel Rebecca Bryan Allison, M.B., Ch.B. (New Zealand).
Douglas Henning Belfrage, M.B., B.Ch. (Camb)., L.R.C.P., M.R.C.S.
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THE AUSTRALIAN SOCIETY OF ANÆSTHETISTS

OUR colleagues in Australia are a progressive body, as many of our readers no doubt have already realized after meeting the secretary of the Association when he visited this country. We have no doubt that readers of this journal have full sympathy with their Australian colleagues and would gladly do anything in their power to help forward their efforts to raise the standard and the status of anæsthetists overseas. For this reason we are glad to make known to our readers the fact that the Australian Society propose to form a reference and lending library, to be housed in one of the capital cities as determined by the Committee of the Society. Although no appeal has been issued to anyone out of Australia, gifts of books and reprints from this country would no doubt be most welcome, and he would urge any of our readers who have such things at their disposal to send them to the Secretary of the Society at 14 Collins Street, Melbourne, C.1.

We notice that the Society are to hold a meeting during the present month, and that they are making a very interesting and penetrating investigation by private questionnaire into the details of practice of their members. We hope that much benefit may accrue from this original and courageous effort.

ABSTRACTS

"The use of inert gases in anæsthesia atmospheres." G. E. BURFORD, *Anæsth. and Analg.*, September–October 1938.

The author produces good evidence in support of the view that much pulmonary trouble after anæsthesia is atelectosis due to deficient presence of inert gas into inhaled anæsthetic atmosphere. The danger would be especially liable to arise in association with the use of cyclopropane in a high percentage of oxygen; and instances of massive collapse of the lung after cyclopropane have been described and attributed to the deficiency of inert gas.

The author makes the interesting point that experimentally animals have suffered massive collapse after breathing atmospheres containing high oxygen percentages, and these can be better explained along the lines of deficient inert gas than those of poisoning, hitherto the accepted solution. The article contains accounts of eight cases of massive collapse after anæsthesia. The author holds that as a routine some slowly absorbable gas should be added to the anæsthesia atmosphere to replace the inert gas in air normally breathed but seriously lacking in anæsthetic atmospheres. Helium is at present considered the most reliable gas for the purpose.

"Determination of acetone in expired air; its value in anæsthesia." P. H. LORHAM, *Current researches in Anæsth. and Analg.*, vol. xvii, No. 6, p. 316.

The author remarks that although analysis of the urine would give the desired information, this method entails delay so that the determination of acetone bodies in the breath saves time. It has been shown that acetone passes from the blood to the alveoli by diffusion, that the acetone content of blood and of alveolar air are proportional; thus acetone in

the breath is a rough index of acetone in the blood. The patient is tested both before and after operation, the method of determination of acetone being that of Roth. Some of the conclusions arrived at are: Patients undergoing emergency operations develop acetone in greater amounts and more often than others; children are more prone than adults to the symptom. Trauma is a marked factor in the production of acetone. The general condition of surgical patients improves more readily if acetone be prevented or kept negligible in amounts. A simple measure for this is pre-operative administration of fruit juices with glucose solution. After operation 5 per cent saline-glucose will reduce the amount of acetone present.

"*Advantages and disadvantages of cyclopropane.*" M. C. BECK, *New Orleans Med. and Surg. Journ.*, January, p. 369.

Alluding to the risk of atelectasis after cyclopropane inhalation, the author recommends that as a routine either helium should be added to the inhaled gases or else hyperventilation should be produced after operation by blowing a stream of carbon dioxide on the face. He regards anæmia, heart disease, hyperthyroidism, respiratory obstruction, and thoracic surgery as definite indications for the use of cyclopropane, and holds that it is the anæsthetic of choice for the bad-risk patient. Beck claims that after abdominal operations distension is less when cyclopropane has been the anæsthetic than when ether is used because in cyclopropane anæsthesia the tone of the intestinal tract is not lost and peristalsis continues.

"*A comparison of ether, spinal and cyclopropane anæsthesia.*" J. C. HOUSTON, *Canadian Med. Journ.*, February, p. 143.

The author decides wholeheartedly in favour of cyclopropane. He reckons it even safer than ether. With regard to the latter, he relates one fatality which needs explaining. The patient was a woman in normal health who died five minutes after the operation started. Unfortunately there was

no post-mortem examination, and no details of the operation are given. He appears to meet with an unusual amount of respiratory depression during ether administration, very likely, as he suggests, due to heavy pre-medication. The records of six years at the Bruce Edward Island Hospital are given, and it is on these that he bases his conclusions. During the last year 41 per cent of the administrations were with cyclopropane and 10 per cent of the operations were done under spinal analgesia. He states that cyclopropane gave insufficient relaxation in 50 per cent of the cases. Spinal has not been used for operations above the diaphragm.

"*Electro-narcosis.*" A. DÉNIER, *Anæsth. et. Analg.*, vol. iv, No. 4, p. 451.

The author recalls the electric experiments of Leduc (1903) and later of Kalendaroff, the latter of whom he has to some extent corroborated before designing new experiments of his own. The difficulty is to obtain anæsthesia without convulsions or contraction. It may be recalled that Leduc produced electric sleep in animals by means of interrupted currents of low tension and even on two occasions anæsthetized himself. Studies of galvanic currents on nerves show that the anode increases functional activity of the nerve and the cathode diminishes it. With regard to semi-permeable membranes the anode acts like calcium and diminishes permeability, while the cathode like potassium increases it. Demole in cats produced sleep by injecting chloride of calcium into the basilar region.

Hess, by means of micro-electrodes, passed a continuous current through the subthalamic region of the cat. Sleep came on, not a paralytic phenomenon but an active inhibition of certain functions of the organism. The centre is not narrowly circumscribed; it includes many points near the median mesencephalic region and would be spread over the length of the cerebrospinal axis.

The author having met the common difficulty of obtaining anæsthesia unaccompanied by contraction with intermittent currents of low tension, has experimented with high frequency currents at a rate of 16 to 23 micro seconds. He has obtained anæsthesia without contraction in animals, and he

hopes to extend his researches to the human subject. Already he believes therapeutic effects on vascular troubles have been achieved by the method.

"Cardiac depression from barbiturates." R. L. JOHNSTON, *Journ. Pharm. and Exp. Therap.*, 1938, lxiv, p. 30.

Barbituric acid derivatives have long been known as powerful respiratory depressants, and various investigators have laid emphasis on the use of respiratory stimulants as antidotes. The barbiturates also have a depressant action on the heart and in an attempt to evaluate the antidotal effect of various drugs, Johnston used isolated turtle hearts. It is probable that his results can be applied in medicine. Barbiturates have a twofold depressant action on the turtle heart: (*a*) through the vagus mechanism, and (*b*) directly on the cardiac muscle, manifested by gradual slowing, and finally heart block. Atropine and glycine are useful in counteracting these two types of depression, but with prolonged perfusion the depressant action finally predominates. Coramine and metrazol slightly decreased barbiturate depression, but were less effective than some of the so-called purine bodies, of which theophylline-calcium salicylate (phyllicin) was the most effective. None of the drugs used proved to be the ideal antidote, for in all, with prolonged perfusion, the depressant finally predominates.

"Vinyl ether (vinethene) in childhood." R. E. GROSS, *New England Journ. Med.*, February 23, 1939, p. 14.

The author believes vinyl ether to be particularly adapted to surgical procedures of short duration in infancy and childhood. He reports on a series of 100 cases. Used on adults, the drug had produced narcosis rapidly, given adequate relaxation, a short recovery period, little post-anæsthetic reaction, and a high degree of safety. It was therefore decided to try it on children on a larger scale than had yet been attempted. The results have been so satisfactory that vinyl ether "promises to assume a permanent place in the armamentarium of one who has occasion to undertake minor procedures in young individuals." The type of case in which vinyl ether is particularly useful is that so often encountered

in the out-patient department or in pediatrics. Aural paracentesis, removal of deeply embedded splinters, suture of small lacerations, and drainage of abscesses, and endothermy coagulation of hæmangiomata are some of the examples given. Vinyl ether can also be employed with advantage as the induction agent before longer-lasting anæsthetics, for appendix and tonsil operations for example. It has been employed for infants as young as one month with most satisfactory results.

The author recommends that an open method be used on a mask covered with six or eight layers of gauze. At first two drops a second are applied. Induction rarely needs more than 49 seconds. Premedication is not necessary.

CORRESPONDENCE

THE ETHERINGTON-WILSON TECHNIQUE.

To the Editor the British Journal of Anæsthesia.

Sir,—I have not hitherto joined in the correspondence on the dangers of the Etherington-Wilson spinal technique as I have a high regard for this surgeon personally and do not wish in any way to disparage his work. At the same time the increasing number of accidents makes it imperative that we should review the subject and decide once and for all if this method is sound.

The technique was based on the rate of ascent of hypobaric coloured solution in glass tubes shaped to represent the dural sac. It has often been pointed out that in the living subject this space is not vacant, but in its upper part is occupied by the spinal cord and roots, and in its lower part by the cauda equina. It would seem more reasonable therefore if the model was filled with sponge.

Torkel in Germany and Koster in America, after considerable study of the subject, came to the conclusion that there is little resemblance between artificial models and the living subject in the conditions of diffusion of fluids.

Supposing that the foregoing objection can be dismissed as trivial and that glass models do actually resemble the living dural sac, are we even then on sure ground? I would suggest that we are not, as we are dealing with an unknown factor.

Mr. Etherington Wilson, in his experiments, assumed that the specific gravity of cerebro-spinal fluid was 1.007. The greatest authority on this subject is, I think, Kafka. In 1930 he reviewed all the available data and added statistics of his own. Kafka gives the normal specific gravity of

cerebrospinal fluid obtained by lumbar puncture as 1.006 to 1.009, and that obtained by cisternal puncture as 1.004 to 1.008. It is by no means uncommon, however, for lumbar fluid to vary from 1.0038 to 1.010. In other words, the usual 1 in 1,500 percaine in 0.5 per cent saline solution may be strongly hypobaric or nearly isobaric in any given case. If the original Howard-Jones technique or its modification for unilateral blocks is used, the difference in specific gravities will not materially affect the result. If, however, the Etherington-Wilson sitting-up method is employed the rate of ascent must vary with the difference in specific gravity between the injected solution (1.0036) and the individual cerebrospinal fluid. This appears to me to offer a reasonable explanation of some of the accidents which have occurred.

It is worth noting that when 1 per cent pantocaine was first introduced it was reputed to be isobaric (s.g. 1.0068). So many accidents occurred that a special test was devised to ascertain whether the solution was hypo-, iso- or hyperbaric in any given case. A test solution was used which was a mixture of xylol and chlorobenzene in such proportions as to have a specific gravity equal to that of 1 per cent pantocaine. A drop of cerebrospinal fluid is placed in a test-tube of the test solution and will sink if it is heavier and float if it is lighter than the pantocaine. The very fact that this was found to be necessary demonstrates the considerable differences in specific gravity found in normal cerebrospinal fluid.

Yours faithfully,

C. Langton Hewer.

ADVOCATING VINESTHENE.

To the Editor the British Journal of Anæsthesia.

Sir,—I think it would be a very great advantage if you could persuade some of our more expert anæsthetists to discuss in your Journal the relative advantage of cyclopropane and vinesthene and vinesthene anæsthetic mixture.

We general practitioners are anxious to do the best for our

patients and sometimes feel that we ought to be using cyclopropane, but the expensive and complicated apparatus necessary and the degree of skill required for the administration of cyclopropane make us hesitate to adopt the use of this anæsthetic agent if we can obtain adequate results with a more simple and more easily administered anæsthetic. Vinesthene appears to have such great advantages, it is so easy to administer, and so reasonable in cost, that we are rather tempted to use this instead of cyclopropane.

I have found that vinesthene-ether mixture is particularly useful when used in a Boyle's apparatus in conjunction with nitrous oxide and oxygen. The induction of the anæsthetic is extremely easy and smooth and a reasonable degree of relaxation can be obtained with a very light anæsthesia. It is most particularly useful for emergency surgery with which we so often have to deal. For example, in serious head injuries it appears to be an almost ideal anæsthetic (such operations as decompression or tying the middle meningeal artery) as a very quiet light anæsthesia is obtained. It is also extremely useful for the reduction of fractures, dilatation and curettage and lower abdominal operations.

It appears to me that vinesthene-ether gives far more adequate relaxation than cyclopropane and it does not appear to have any more unpleasant after-effects. Vomiting certainly occurs, but is usually of a mild type and the patient readily recovers consciousness. It does not appear to be irritating to the respiratory passages, and I have given gas-oxygen-vinesthene-ether mixture for one or two operations for the draining of empyema with most satisfactory results.

The anæsthetic, however, does not appear to be in very general use and one would like to have a little more authoritative guidance and advice as to the relative merits of cyclopropane and vinesthene and vinesthene-ether mixture.

I am, Sir, yours faithfully,

JOHN ELAM.

REVIEWS

" The physiology of anæsthesia." H. K. BEECHER, M.D., Instructor in Anæsthesia, Harvard Medical School, pp. 388; price 17*s.* 6*d.*; Oxford University Press, 1938.

This is, we believe, the first book occupied solely by considerations of the physiology of anæsthesia. It is likely to be of great service as well as interest to all anæthetists, for the subject is treated in a most comprehensive manner. When we say that the bibliography alone occupies nearly forty-five pages our readers will realise with what thoroughness Dr. Beecher has carried out his task. After a discussion of the general characteristics of anæsthesia and of the various theories of narcosis, he describes spinal and local anæsthesia and then goes on to miscellaneous effects and chapters on respiration and circulation in anæsthesia. The various anæsthetics are separately considered, and here we may draw attention to an opinion from which many practising anæsthetists will dissent. Having stated that ethyl chloride produces harmful cardiac effects similar to those caused by chloroform, he says that " its use in general anæsthesia is unjustified for the same reasons." Theoretically and physiologically this may be true. Actually in practice it is not. Used for short operations and for induction, ethyl chloride is of enormous value and is safe when properly used. The early cardiac effects so dangerous with chloroform do not show themselves clinically. Overdose and a comparatively late effect are the risks with ethyl chloride and are constantly avoided when proper skill is used in administration. Dr. Beecher is illuminating on the subject of convulsions during anæsthesia and shows good ground for regarding " ether convulsions " as in all probability the result of anoxia, an opinion already held by many anæsthetists, though not generally on the sound foundation laid down by Dr. Beecher.

Intra-traumal pressure and cortical electrical waves are some of the more obscure problems on which the book sheds light. Shock and blood-states during anæsthesia are other matters elucidated, and the book is so full and so sound that no anæsthetist should fail to give it a careful reading.

"The evolution of obstetric analgesia." W. M. CLAYE, M.D., with a chapter by Stanley Sykes, M.D.; pp. 103; price 6*s.*; Oxford University Press, 1939.

To any of our readers specially interested in anæsthetics for midwifery this little book will afford much enjoyment. It is admirably written and the history of the alleviation of pain at confinements is told in a clear and interesting fashion. There is no attempt to make the book a practical text-book or anything of that kind, but Dr. Claye gives a first-rate account of the method which he himself most favours. This is twilight sleep, and his particular modification of it is employed by using the combination of pernocton and scopolamine. The process is started by an intravenous injection of 4–6 cc. pernocton given at the rate of 1 cc. in two minutes. Immediately after withdrawing the needle a hypodermic injection of scopolamine (4/1000 or 5/1000 gr.) is given and half an hour later, or sooner if it appears necessary 2/1000 or 3/1000 gr. Approximately hourly doses of 1/1000 to 5/1000 gr. are required after, individual variation being considerable. Chloroform is given terminally in very small doses to control restlessness and after delivery the patient usually sleeps for several hours.

Dr. Claye approves of the barbiturates, generally speaking, for obstetric analgesia. He points out that twilight sleep properly conducted is illsuited to general practice; no doubt because the constant presence of the obstetrician is necessary. His remarks on the proper respective roles of nurse and doctor at the culmination of a confinement are likely to receive warm approbation from anæsthetists. He shows that the doctor should appropriate the anæsthetic and leave the nurse the only part of the proceeding with which she is competent to deal, viz. the delivery of the child.

"*Spinal anæsthesia.*" G. H. MASSON, M.B., M.D., Practising specialist in anæsthetics, Harborview Hospital, Seattle, with a foreword by W. W. Babcock, M.D., Professor of Surgery, Temple University School of Medicine; pp. 409, illustrations, 68; price 30*s*. J. B. Lippincott Co., Philadelphia, London, New York, Montreal.

We have read this book with great pleasure. It is, we believe, the most comprehensive exposition of spinal anæsthesia in the English language and should be read by every anæsthetist who uses the method. Perhaps the most striking feature of the book as a whole is the author's fair-mindedness and absence of prejudice. He makes plain what is his favourite technique and why, but he gives detailed accounts of all the methods employed and recommended by other authorities. In the same spirit he does not claim that spinal methods are always to be chosen. With regard to relative safety, he writes with the sense and judgment that guide him throughout. Statistics, consequently, of anæsthetic mortality weigh little with him. He proves well the case that with proper selection of patients and scrupulous care in technique spinal anæsthesia is made at least as safe as any other method of anæsthesia. The special type of person for whom he thinks it is generally the method to be chosen above all others is the robust individual undergoing an abdominal operation, the type of person who offers special obstacles to success with inhalation methods.

The early part of the book is taken up with an admirable and finely illustrated account of the spinal column and its contents; the anatomy and physiology of the cerebrospinal fluid and of all structures concerned in spinal injection anæsthesia are described in a full and lucid manner. The principles of the method are fully expounded and the different drugs and techniques by which these are put into practice. The author is a firm believer in the invariable combination of pre-medication with spinal methods. In this connexion he approves of the barbiturates as well as of morphine and atropine. Unwanted sequelæ of spinal infection are, he believes, almost completely avoided by scrupulous care in the surgical cleanliness and the minimum trauma of the

technique employed. Only a certain small amount of pulmonary after-effects seems to be unavoidable. The much discussed question of the cause of low blood-pressure during spinal analgesia is fully ventilated. Its causation, as well as that of depressed breathing or of vomiting during spinal anæsthesia, are fully explained. The author approves of spinal methods for Cæsarean section to a degree which is not, we think, supported by the best gynæcological opinion at the present time.

We note a misprint on page 105, where "hypo-" should surely be "hyperbaric", but the book is beautifully printed and produced. The author's industry in consulting the writings on his subject has evidently been immense. He weighs the views and evidence with nice judgment and never puts forward his own opinions without substantiating them fully from his own experience as well as from that of others. The book concludes with a chapter on total and segmental spinal anæsthesia and an excellent bibliography. We wish to congratulate Dr. Masson on his achievement and believe that his work will be of the utmost value for a long time to come to all who practise spinal methods of anæsthesia.

ERRATA

In Dr. Steel's contribution to the last number there were three incorrect figures:

p. 64 line 11, 1/5 should be 1/150.
p. 64 line 27, 5 per cent should be 50.
p. 65 line 13, 2.5 per cent should be 25.

NOTICE

We wish to direct the attention of our readers to the letter, reproduced below, which appeared in *The Lancet* of March 11th over the names of Mr. L. Colledge and Dr. C. F. Hadfield.

Explosions in Operating-Theatres.

Sir,—We have been asked to join a committee appointed by the Institution of Electrical Engineers to consider the question of electrical safety in relation to the equipment of operating-theatres and adjacent rooms where there may be danger of explosion of anæsthetic vapours. The committee includes Mr. H. W. Swann, nominated by the Home Office, and Dr. E. H. Rayner, of the National Physical Laboratory. It is known that 23 explosions caused by some form of electrical ignition had occurred in this country before the end of 1935, of which 14 were attended by fatal results; but it is probable that the number of explosions is much larger than this, since there is no obligation to report them to any central authority.

The work of the committee would be much helped if any anæsthetist or surgeon in possession of first-hand knowledge of any explosion of this nature would supply us with a detailed account of the case. The chairman of the committee is Mr. H. T. Young, past president of the Institution of Electrical Engineers, and he would be most grateful for any information, which would be regarded as strictly confidential. Communications could most conveniently be sent to Dr. C. F. Hadfield, 47 Queen Anne Street, W.1.

The Editor apologizes for the delay in publication of this number, which is due to printing conditions over which he has no control.